

French Academy of Sciences, at which fifty-six representative astronomers from all parts of the world were present, a scheme has been approved for the formation of a photographic map of the heavens by the concerted action of a number of Observatories in both hemispheres. This scheme provides for two series of photographs, the one intended to contain all stars down to the fourteenth magnitude inclusive, and the other, taken with short exposure, specially designed to give accurate positions of brighter stars down to the eleventh magnitude, so that it may be possible to form an extensive Catalogue of reference-stars for the first series, and thus to give the means of accurately determining the position of any star on the photographic map down to the fourteenth magnitude. The instruments with which this work is to be jointly carried out are to be photographic refractors of 0.33m. (13 inches) aperture and 3.43m. (11 feet 3 inches) focal length, and the Directors of the following ten Observatories have already announced that they are prepared to take part in the enterprise: Algiers, Bordeaux, Paris, Toulouse, and Vienna in the northern hemisphere; La Plata, Melbourne, Rio de Janeiro, Santiago da Chile, and Sydney in the southern hemisphere. It seems fitting that Greenwich should take its share in a scheme which will in a few years so greatly extend our knowledge of the places of the fixed stars, and thus serve to carry out one of the principal objects for which the Astronomer-Royal was appointed.

"On a review of the work of the past twelve months, it will be found that the activity of the Observatory has increased in various directions. The number of meridian observations is much larger than usual; additions have been made to the work of the magnetical and meteorological branch; there have been continuous trials of chronometers and deck-watches (requiring special arrangements in each case), which have made large demands on my own time, as well as on that of Mr. Turner and of Mr. Lewis. Extraneous work in connexion with the Navy has also absorbed a good deal of time that would otherwise have been free for scientific investigations. Questions connected with gun-directors, mirrors for electric search-lights, and binoculars for the Navy, have continued to engage our attention, and since the date of the last Report 510 telescopes and 35 binoculars for the Navy have been sent to the Observatory for examination, whilst it is to be presumed that a further supply of 500 binoculars, now on order, will be forwarded here to be tested in due course.

"Whilst it seems desirable that such directly utilitarian work should be undertaken at the Observatory, as being the only existing Government establishment where it can be done efficiently, I feel it necessary to point out that the existing staff is inadequate for these extraneous duties in addition to the well-defined work for which the Observatory is primarily maintained. By great efforts, which can hardly be sustained for an indefinite period, the current reductions have been kept up, notwithstanding the large number of observations obtained in the last twelve months, but the ulterior discussions which are required to maintain the character of the Observatory as a scientific institution are falling further and further behind. Amongst other matters which I should wish to take up, if leisure could be found, I may mention the determination of proper motions of stars from the observations made at Greenwich since Sir G. B. Airy's appointment in 1835, an investigation which appears to come within the terms of the Royal Warrant directing the Astronomer-Royal 'to rectify the tables of the motions of the heavens and the places of the fixed stars.'

"The appointment of a clerk, which has presumably received the sanction of the Admiralty, will, when it is made, provide for the increase of office-work which has taken place of late years in regard to chronometers, accounts, stores, stationery, printing, &c., and if the maintenance of the telegraph-wire, batteries, &c., for communication of time-signals were undertaken by the Post Office Telegraphs as part of the distribution of time to the public, there would be some further relief. But to enable me to give time to extraneous questions referred to the Astronomer-Royal by the Government, it appears necessary that the Chief Assistant and I should be relieved of certain mechanical work which might be intrusted to computers, and that further responsibility should be delegated to the Assistants. Proceeding on the lines which have been laid down by my predecessor, I believe that the maximum of efficiency at the minimum of cost would be attained if an increase of work were met by an increase in the staff of computers, with due recognition of the position of two or three senior computers, and of the increased responsibility of the Assistants."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—In Convocation on Tuesday, a grant of £4800, applied for by Prof. Clifton, for the extension of the Clarendon Laboratory by the erection of buildings for an Electrical Department, was refused by a large majority.

Twenty-seven men have entered for the final schools in Natural Science this year, of whom sixteen offer chemistry, four physiology, three animal morphology and physics, and one botany.

A course of medical teaching, including clinical demonstrations and elementary surgery, is to be given at the Radcliffe Infirmary during the first half of the Long Vacation.

Besides the lectures which we announced at the beginning of term, Mr. Arthur Evans, the Keeper of the Ashmolean Museum, is giving a course of lectures on "The Early Iron Age."

CAMBRIDGE.—The twenty-first Annual Report of the Museums and Lecture Rooms Syndicate states that during the year 1886 considerable progress has been made in arranging the various collections, but additional accommodation in the form of cases and cabinets is required in various departments, especially for botany and ornithology. Additional accommodation is urgently demanded for the teaching of physiology, pathology, and botany. It is also desirable that permanent arrangements for human anatomy and medicine should be taken into consideration without further delay, and that the work should be commenced as soon as possible after the present chemical laboratory is vacated.

Mr. J. W. L. Glaisher, F.R.S., and Mr. J. S. Nicholson, Professor of Political Economy in the University of Edinburgh, have been approved for the degree of Doctor in Science.

The University having been applied to by the Association for the Improvement of Geometrical Teaching to take some steps to give improved methods of teaching geometry fair play in their examinations, and the Association having sent a deputation to Cambridge to confer with the Board of Mathematical Studies, the latter Board have recommended that other proofs than Euclid's be accepted in the Previous Examination, no proof of any proposition occurring in Euclid being admitted in which use is made of any proposition which in Euclid's order occurs subsequently. They do not at present propose modifications in the syllabus of geometry for the Mathematical Tripos, because they are about to revise the schedule of Part I. as a whole.

The recent report on the local lectures scheme shows that a fair share of attention has been devoted to natural science—namely, thirty-five out of one hundred courses of lectures. The courses on "Work and Energy" by Mr. A. Berry, delivered at five centres in the Northumberland mining district, were very successful. There is distinct progress in the systematization of work, and the development of local centres; but there are many difficulties owing to lack of endowments. Attempts are being made to connect practical courses of instruction with the scientific lectures, but here again the lack of apparatus and laboratories is a serious disadvantage. An endowment fund of £1136 has been contributed, of which more than half is given by the Local Lectures and Examinations Syndicate. The chief purpose contemplated is the retention of the services of practised lecturers.

The class list of the Natural Sciences Tripos, Part I., just issued, contains the following names in Class I.: Anderson, Cai.; Barber, Chr.; Colbeck, Cai.; D'Albuquerque, Joh.; Dufton, S. F., Trin.; Dufton, A., non-collegiate; Elliott, Chr.; Francis, King's; Fry, King's; Grabham, Joh.; Groom, Joh.; Richardson, King's; Tennant, Cai.; Turner, F. M., Trin.; Waggett, Pemb.; Wagstaff, Sid.; Williams, Cai.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, May 28.—Prof. W. E. Ayrton, Vice-President, in the chair.—Dr. S. P. Thompson read a note on transformers for electric distribution. In the simple algebraic treatment of the dynamo several assumptions approximately true for well-made machines are made use of. The author finds that a similar set of assumptions for transformers greatly simplifies the algebraic theory:—(1) The iron, copper, and insulation are assumed good. (2) The reaction of the secondary on the primary (other than that desired) is small; thus, if the primary be

supposed to be supplied with constant mean current or constant mean potential difference, this is not to be altered by the current in the secondary. (3) No magnetic leakage; so that the coefficient of mutual induction is the geometric mean between their coefficients of self-induction. (4) The quantities of copper in the primary and secondary are to be equal. These assumptions are shown to be legitimate, and the ratios of the resistances, E.M.F.'s, currents, and coefficients of self-induction are expressed in terms of the ratio of the numbers of convolutions, which ratio is represented by $p = \frac{S_1}{S_2}$. From analogy with the dynamo it is

shown that $E_2 = \frac{\omega M}{\sqrt{R_1^2 + \omega^2 L_1^2}} E_1$, where $\omega = 2\pi n$, E_1 and E_2

the E.M.F.'s of the primary and secondary respectively, and R_1 and L_1 the resistance and self-induction of the primary coil.

If R_1 be negligible, the above reduces to $E_2 = \frac{\omega M}{\omega^2 L_1^2} = \frac{E_1}{p}$,

since $\frac{L_1}{L_2} = p^2$, and $M = \sqrt{L_1 L_2}$. The latter part of the paper

contains a general investigation of two neighbouring circuits both having self-induction, and it is shown that the effective resistance of the primary is increased, and the self-induction decreased by closing the secondary circuit. Mr. Kapp said the investigations assumed the coefficients of induction to be constants, and that the phases of current in primary and secondary were opposite. The former being by no means true, he asked, What values were to be taken? and he believes the phases of current are not opposite in ordinary transformers. Mr. Swinburne protested against the use of formulæ to calculate the inductions when the required data could be obtained much more accurately from Dr. Hopkinson's curves on magnetization of iron. He also thought the curve of sines did not nearly represent the current curve for ordinary machines. Mr. Bosanquet thought the effective magnetization of a transformer would be different from that of a dynamo, for, in the former, permanent magnetism was not utilized. In reply to Mr. Kapp and Mr. Swinburne the author pointed out that as the coefficients of induction enter in both numerator and denominator, it would not matter which set of values were taken if the resistance was small compared with ωL ; and that self-induction tends to smooth out irregularities in the current curve. Prof. Ayrton described a method of regulating a series transformer devised by himself and colleague some two years ago, based on analogy with a compound dynamo. Referring to the variation of L with current, he sketched a curve connecting them, obtained by Mr. Sumpner at the Central Institution, and mentioned that the E.M.F. curve of a Ferranti dynamo is an exact sine curve. He believes problems involving alternating currents would be greatly simplified by using a new set of measurable quantities, such as will render the equations as simple as possible. At Prof. Thompson's request, Prof. Ayrton exhibited a lecture experiment illustrating the action of transformers. The secondaries of two ordinary induction coils were joined in series through long fine wires, and an incandescent lamp placed in the primary circuit of one, lighted up on completing the primary of the other coil in which a battery was placed.—On magnetic torsion of iron wires, by Shelford Bidwell. This is an account of experiments made on the twisting produced by sending a current along magnetized iron wires, and the author shows that Wiedemann's explanation of these phenomena (by assuming a difference in molecular friction at the polar and lateral surfaces of magnetized molecules), is unsatisfactory. The wires were magnetized longitudinally by means of a solenoid in the axis of which the wires were suspended. To obtain consistent results it was found necessary to demagnetize the wire between the observations. This is done by reversed currents of gradually decreasing strength, and a simple arrangement of rheostat and commutator devised for this purpose was exhibited. Two sets of experiments were made, in one of which the current in wire or solenoid was kept constant whilst that in the other was varied. The amount of twisting does not increase continuously when the currents are increased, but attains a maximum when the inclination of the helix, representing the direction of magnetization, is inclined at about 33° to the axis of the wire. When the current in the solenoid was kept constant and that in the wire increased, permanent deflections remained on stopping the current. For small currents in the wire this deflection was diminished on starting the current, whilst stronger currents increased the deflection. For some intermediate value

of the current, no change took place, and this value was dependent on the current in the solenoid. Experiments were shown illustrating these phenomena.

Anthropological Institute, May 24.—Mr. Francis Galton, F.R.S., President, in the chair.—Dr. George Harley, F.R.S., read a paper on the relative recuperative powers of man living in a rude, and man living in a highly civilized state; in which he brought forward a number of hitherto unpublished, though mostly well-known facts, demonstrating that the refining influence of civilization had not been altogether the unalloyed boon we so fondly imagine it to have been. For the cases cited went far to demonstrate the fact that while man's physique, as well as his mental power, had increased during his evolution from a barbaric state into a condition of *bien-être*, his recuperative capacity, on the other hand, has materially deteriorated. In fact, it appeared from the examples cited that every appliance adding to man's bodily comfort, as well as every contrivance either stimulating or developing his mental faculties, while increasing his personal enjoyments materially diminishes his animal vitality; rendering him less able to resist the effects of lethal bodily injuries, or recover from them as well and as quickly as his barbaric ancestors, or his less favoured brethren.—Mr. G. L. Gomme read a paper on the evidence for Mr. McLennan's theory of the primitive human horde: and a communication by Mr. Samuel Gason on the Dieyerie Tribe of South Australia was also received.

Mineralogical Society, May 10.—Mr. L. Fletcher, President, in the chair.—It was reported that Mr. F. Pearce, of Maritzburg, Natal, and Prof. Albert Chester, of Clinton, N.Y., had been elected members in April.—The following papers were read:—Microscopical studies on some eruptive rocks from the Caucasus and Armenia, by Dr. Hjalmar Gylling, of Helsingfors.—Note on some specimens of glaucophane rock from the Ile de Groix, by Rev. Prof. Bonney, F.R.S.—On the crystalline form of kreatine, by Mr. L. Fletcher.—Note on francolite, by Mr. F. H. Butler.—On the meteoric iron seen to fall in the district of Nejed, in Central Arabia, in the spring of 1865, by Mr. L. Fletcher.—On a granite containing andalusite from the Cheesewring, Cornwall, by Mr. J. J. H. Teall.—Prof. J. W. Judd, F.R.S., exhibited some specimens and sections of tabasheer and other forms of opal, and made some observations thereon.

PARIS.

Academy of Sciences, May 31.—M. Janssen in the chair.—On the condition of stability in the movement of an oscillating system connected with a pendular synchronic arrangement, by M. A. Cornu. A solution is here offered of a problem which presents itself in the adjustment of certain apparatus of great precision employed in physics and astronomy: how to render the oscillations of a given mobile system, such as a pair of scales or a galvanometer, exactly synchronous with a corresponding periodical motion, such as that of a clock's pendulum, and the like.—On some crystallized metallic alloys of platina and tin, by M. H. Debray. Resuming his former studies of these alloys, the author here deals with those of platina and tin, with formula, $PtSn_4$; of rhodium, $RhSn_3$; of iridium, $IrSn_3$; and of ruthenium, $RuSn_3$. Osmium yields no alloy with tin, in which metal it crystallizes.—Progress of the Arago Laboratory, by M. de Lacaze-Duthiers. An account is given of the improvements lately introduced at this marine zoological station, which has been established at Banyuls. It is now fitted with a 7 horse-power steam-engine for supplying the aquarium with water, and with submarine electric lamps for studying the habits of the Mediterranean fauna.—On a fossilized tendril of *Nymphaea Dumasii*, Sap., by M. G. de Saporta. Although traces of rhizomes of *Nymphaeaceæ* in various Tertiary formations are far from rare, the present fossil is specially remarkable for its great beauty and excellent preservation. Apart from the inner structure, which has been replaced by some amorphous substance, it retains all the exterior outlines of the organ down to the minutest superficial details.—Report on the velocities set up by the tides of the Pacific and Atlantic Oceans in a canal establishing free communication between these two basins, by M. Bouquet de la Grye. This is the Report of the Commission appointed last year at the request of M. de Lesseps to study the influence likely to be exercised on the Panama Canal now in progress by the regular rise and fall of the surrounding waters. It appears that the tidal currents, much stronger on the Pacific than on the Atlantic side, can

never exceed $2\frac{1}{2}$ knots, and that this velocity will be reached only for a few hours at the equinoctial syzygies every year. It is incidentally stated that the Canal will be 72 kilometres long, 21 metres wide at bottom, with a slope of 45° , and a depth of 11.50 metres below the mean level at Panama, and of 9 metres below that of Colon.—Observations of Barnard's Comet (1887 e) made at the Algiers Observatory with the 0.50 m. telescope, by MM. Trépied and Rambaud. These observations give, in tabulated form, the apparent right ascension, the declination, and number of comparisons with other stars for the period from May 16 to May 24; also the positions of the stars and the apparent positions of the comet for the same period.—On simultaneous linear equations with partial derivatives of the second order, by M. Painlevé. Some remarks are offered in connexion with M. Goursat's recent paper on this subject, including the explanation of a different method for obtaining the same results.—On a melograph, by M. J. Charpentier. The apparatus here described and presented to the Academy have been devised and constructed for the purpose of offering a solution of the problem relating to the fixation of musical improvisations, and are applicable to the piano type of instruments.—On the vapour-tensions of liquid cyanogen, by MM. J. Chappuis and Ch. Rivière. While studying the compressibility of cyanogen the authors have had occasion to measure some maxima tensions of this gas, with results differing considerably from those obtained by Faraday and Bunsen. The discrepancies are attributed partly to the great difficulty of introducing cyanogen free from nitre into the barometric chamber; but chiefly to the manometric methods employed by those physicists, these methods being much inferior in accuracy to the open air manometer adopted by the authors.—On the reproduction of a carbonate of soda known as urao and trona, by M. Paul de Mondésir. These remarks are intended to throw some light on the subject of sesquicarbonate of soda, under which title are grouped various more or less unsatisfactory data and observations.—Action of selenious acid on the bixide of manganese, by M. P. Laugier. During the course of his researches to discover an oxygenated product Se_2O_3 corresponding to S_2O_5 , obtained by the action of sulphurous acid on the bixide of manganese, the author has obtained some new compounds, here described, resulting from the combination of selenious acid with the sesquioxide of manganese.—On a simplified calcmeter, by M. A. Bernard. For the apparatus here described it is claimed that it possesses several advantages over that of Scheibler, although based on the same principle.—Researches on the relations existing between the spectrum of the elements of inorganic substances and their biological action, by Mr. James Blake. The author's further researches with over forty inorganic elements confirm his previous conclusions; all except nitrogen and potassium showing a definite relation between their biological action and their conditions of isomorphism.

BERLIN.

Physical Society, May 20.—Prof. Du Bois-Reymond, President, in the chair.—Dr. Gross spoke on the electrical condition of magnets during their magnetization. His experiments were made with Joule magnets. A cylindrical piece of iron was split along its axis, and the lower half of the cylinder surrounded lengthways by the spiral wire which conveyed the magnetizing current, completely insulated from it; the ends of the upper half of the cylinder were perforated by copper spikes, which were then connected by means of copper wires with a galvanometer so as to form a closed circuit. After this circuit, which included the upper half-cylinder, had been brought into electrical equilibrium, the magnetizing current (in the spiral surrounding the other half of the cylinder) was reversed, and the galvanometer gave a throw. The direction of the current thus indicated was always opposite to that of the magnetizing current passing along the inner surface of the half-cylinder. The speaker thought himself justified in excluding the possibility of this result being due to a simple inductive action of the magnetizing current on the galvanometer circuit, inasmuch as when the iron half-cylinder was replaced by one of copper the galvanometer then gave no throw. (In the discussion which followed it was remarked, in opposition to this view, that the resistance of the galvanometer was too great to admit of its indicating a simple induced current when experimenting with the copper half-cylinder.) Similarly, Dr. Gross is inclined to exclude as an explanation any induction of the magnet upon itself, and thinks that the cause of the current is the difference of potential between the inner and outer side of the cylindrical magnet. This point

he proposes to investigate carefully in a future series of experiments.—Prof. Lampe criticised two papers which appeared last year in the *Repertorium für Physik*, of which one contained an explanation of gravitation, the other treated of the motion of a Foucault pendulum. The speaker pointed out very fully the mathematical and physical mistakes which had made it possible for the author of the first paper to regard gravitation as due to the rotation of the earth.—Prof. von Bezold gave an extremely lucid description of Sprung's balance-barograph.—Prof. C. W. Vogel communicated the most recent discovery in connexion with instantaneous photography, by which it is now possible to obtain instantaneous photographs not only at night but also in the darkest places. Messrs. Goedicke and Miethe have prepared a mixture of pulverized magnesium, chlorate of potash, and sulphide of antimony, which when ignited produces an explosive lightning-like illumination of such intensity that by means of it an instantaneous photograph can be taken. The speaker then gave a demonstration of the discovery by taking photographs of several persons present; he used the artificial light, of which each flash lasted one-fortieth of a second, and in a few minutes produced a picture during the meeting. The powders, as prepared by the discoverers, cost only a few pennings each, and will hence readily come into general use.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Papers and Proceedings of the Royal Society of Tasmania for 1886.—Guide to the Science of Photo-Micrography: E. C. Bousfield (Kent).—Questions on Physics: S. Young (Rivingtons).—Encyclopædie der Naturwissenschaften, Erste Abth. 52. Lief., Zweite Abth. 42 and 43. Lief. (Trewendt, Breslau).—Elements of Physiological Psychology: G. T. Ladd (Longmans).—Les Pigmées: A. de Quatrefages (Baillière, Paris).—Official Record, New Zealand Industrial Exhibition, 1885.—Report of the Metropolitan Board of Works, 1886.—British Dogs, No. 7: H. Dalzel (Gill).—Bees and Bee-keeping, vol. ii. Part 8: F. R. Cheshire (Gill).—Reports of Experiments with various Insecticide Substances (Washington).—Our Shade-Trees: C. V. Riley (Washington).—Bulletin of the Iowa Agricultural College, November 1886 (Iowa).—Report of the Felsted School Natural History Society, 1886.—Diseases of the Hair, &c.: J. Startin (Harrison).—International Journal of the Medical Sciences, April (Cassell).—Journal of the College of Science, Imperial University, Japan, vol. i. Part 2 (Tokyo).

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